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Moskovich et al.

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(54) **ORAL CARE SYSTEM AND METHOD**

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(Continued)

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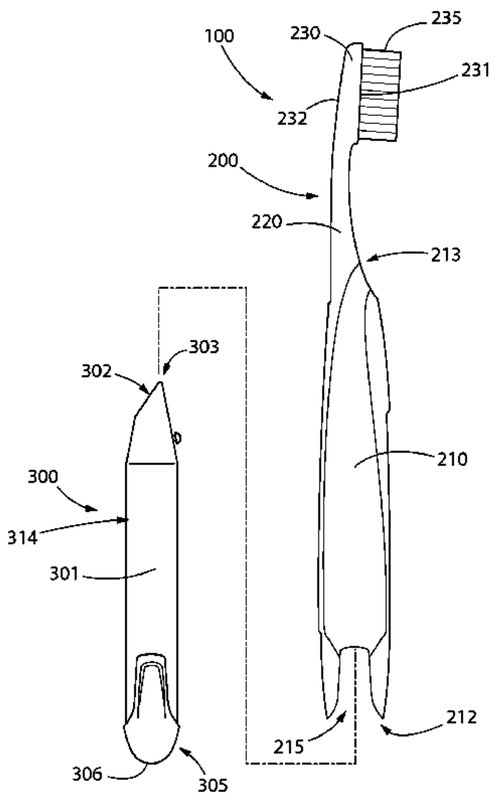
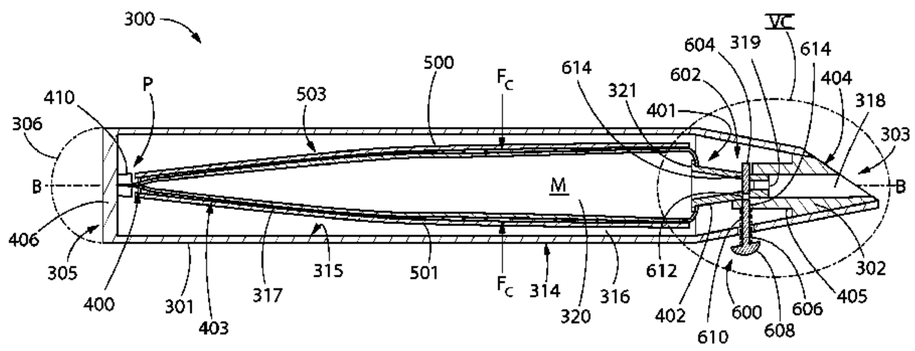
(57) **ABSTRACT**

An oral care system includes a dispenser comprising a product tube having a reservoir containing an oral care material and an outlet. In one embodiment, the dispenser may be configured for detachable coupling to a toothbrush. A compression device engages the product tube and pressurizes the tube contents. The oral care material may be dispensed by actuating a valve fluidly coupled to the reservoir and outlet. In one embodiment, actuating the valve includes a flow orifice movable into and out of a flow path through the dispenser. Oral care material may be dispensed by positioning the orifice in the flow path in which the pressurized material flows outwards the product tube. To stop the flow of oral care material, the orifice is removed from the flow path which blocks the path. An operating button is provided in one embodiment to change position of the flow orifice.

13 Claims, 9 Drawing Sheets





(51) **Int. Cl.**

A46B 9/04	(2006.01)
B65D 35/28	(2006.01)
B65D 35/46	(2006.01)

(52) **U.S. Cl.**
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USPC 401/152, 156, 158, 163, 263, 280; 222/95, 96, 103
See application file for complete search history.

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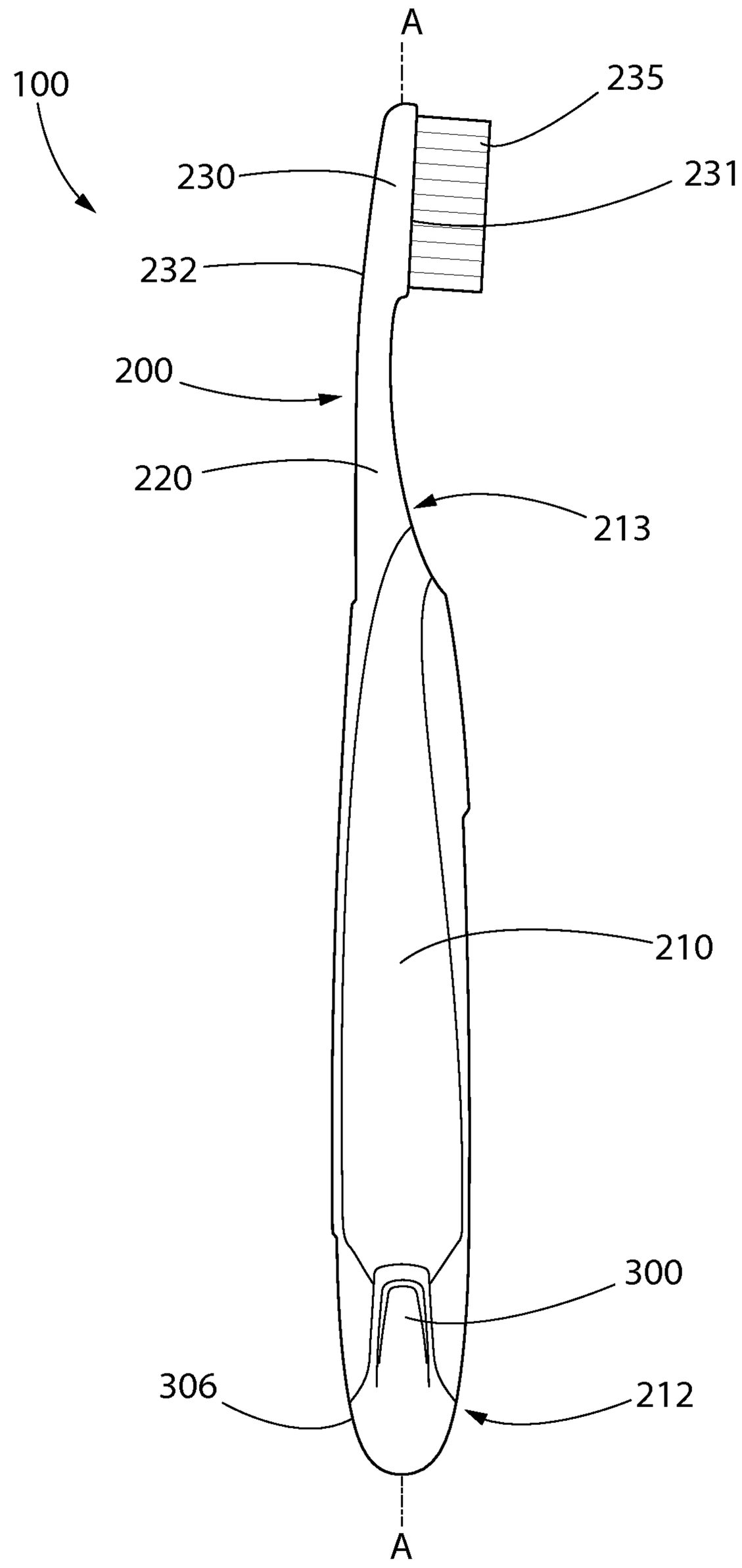
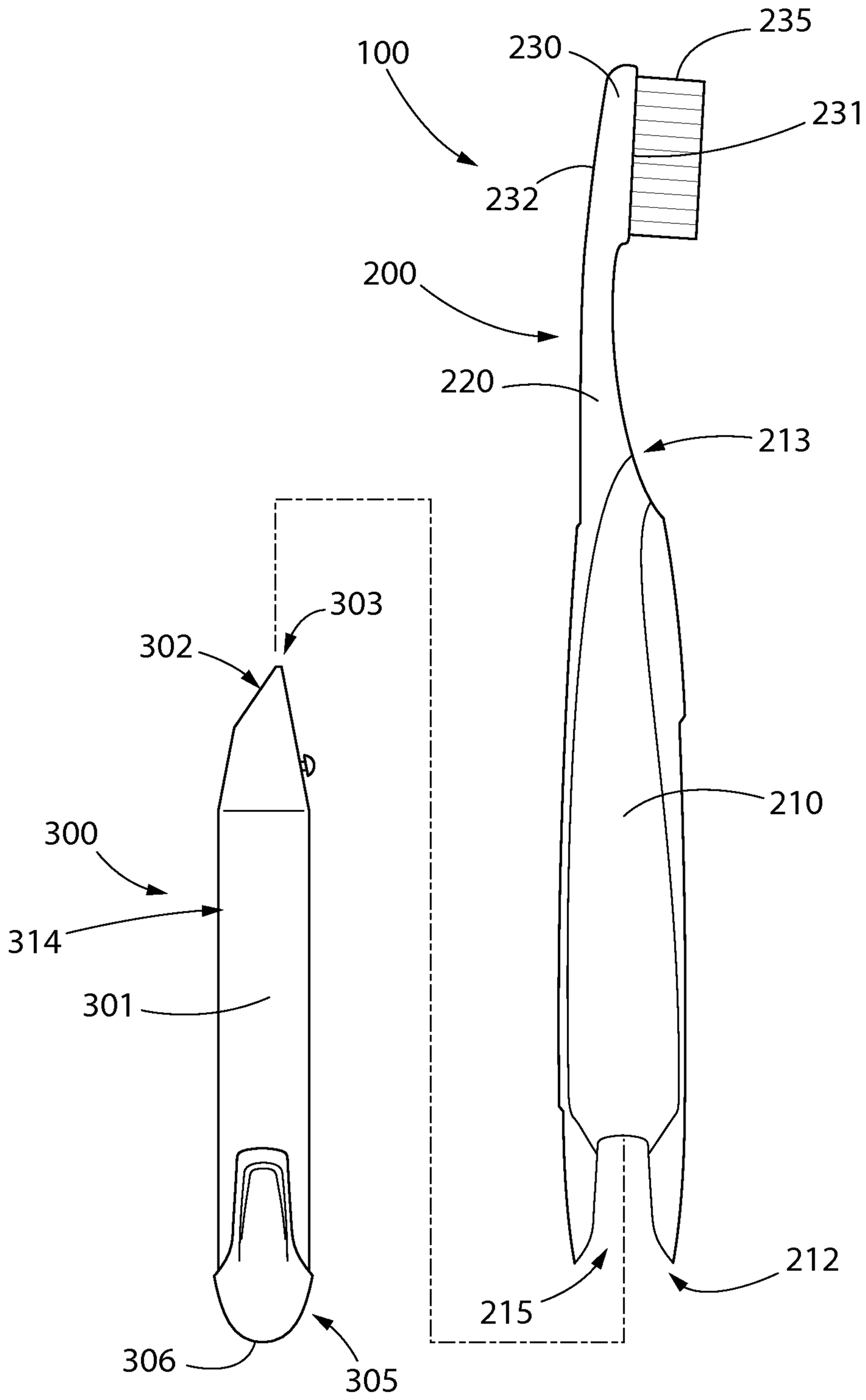


FIG. 1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230
235
231
232
200
220
213
303
302
210
300
314
301
212
215
306
305

FIG. 2

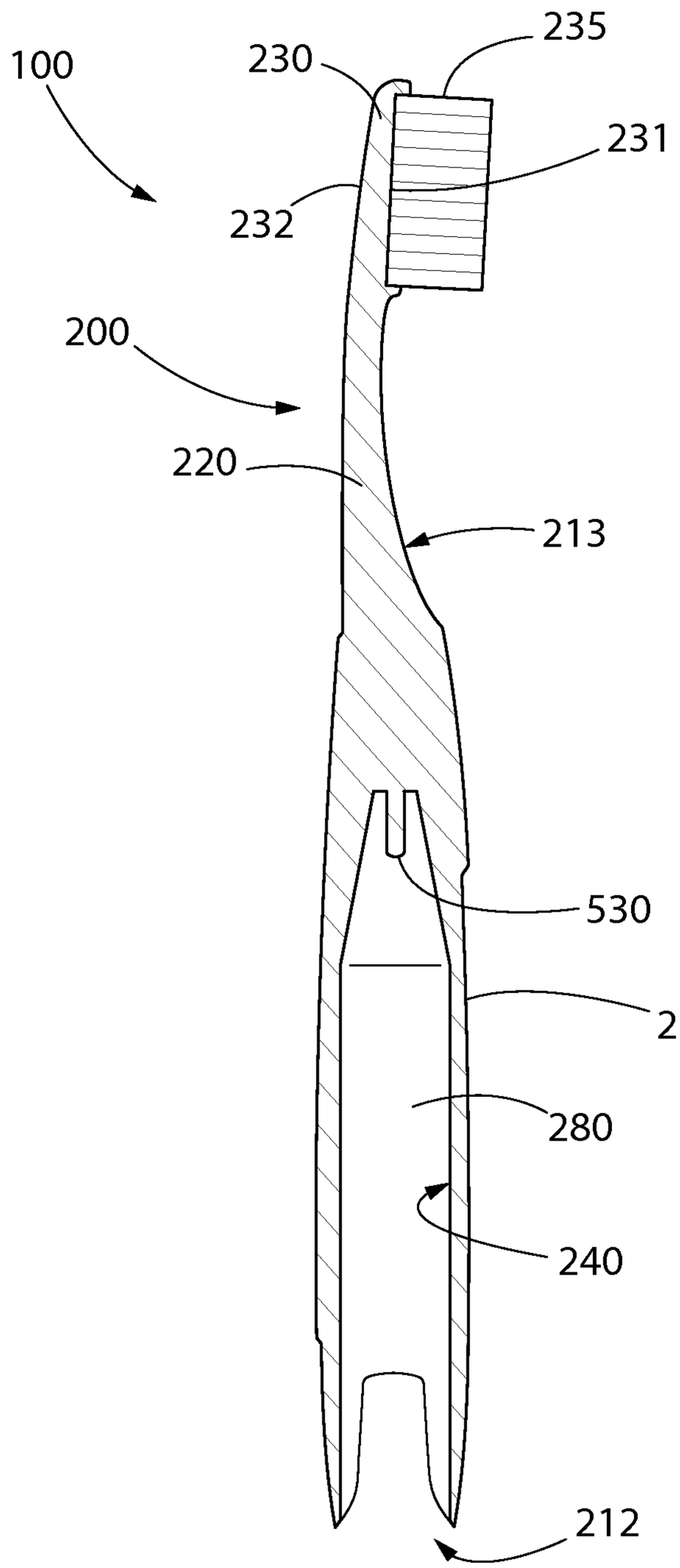
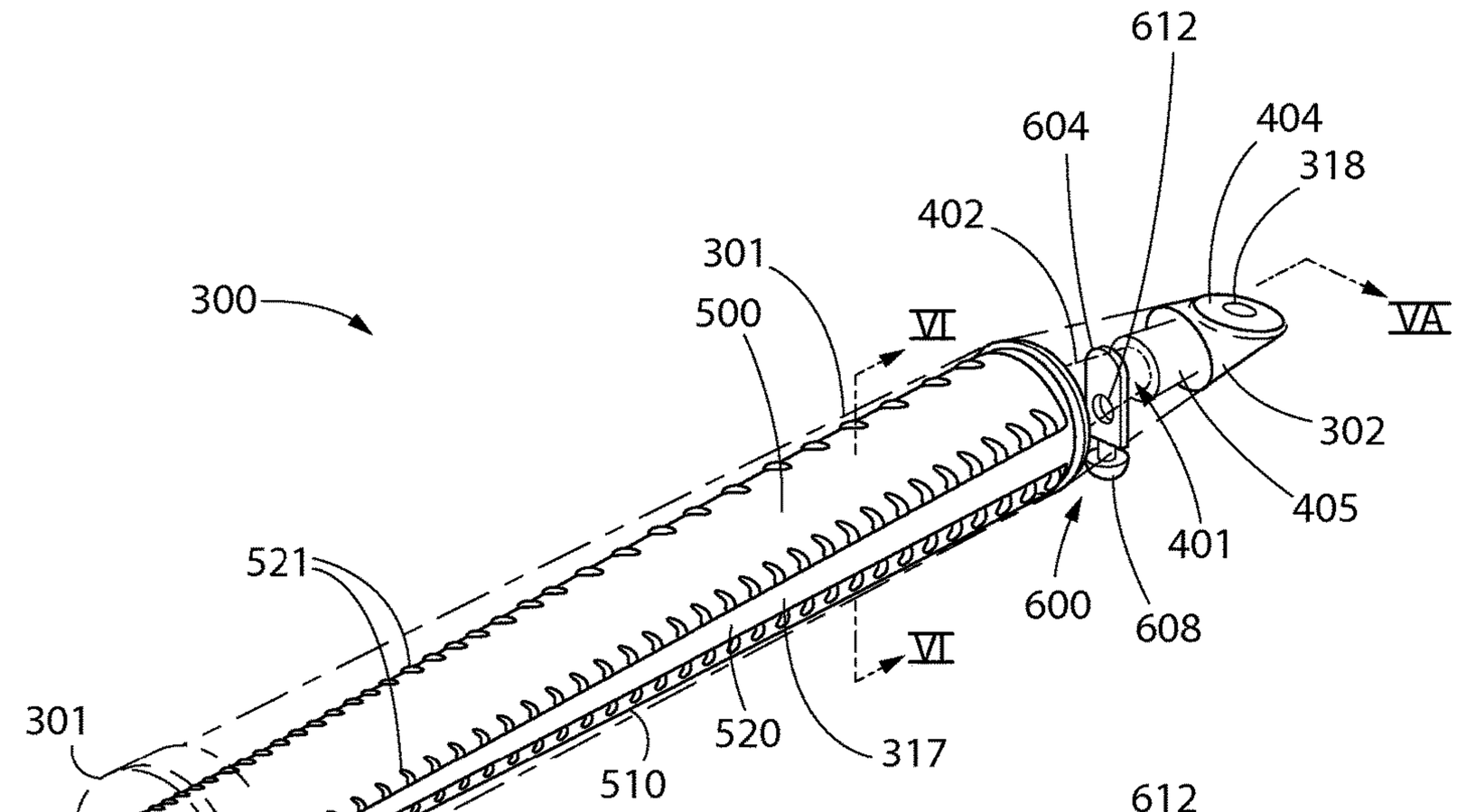


FIG. 3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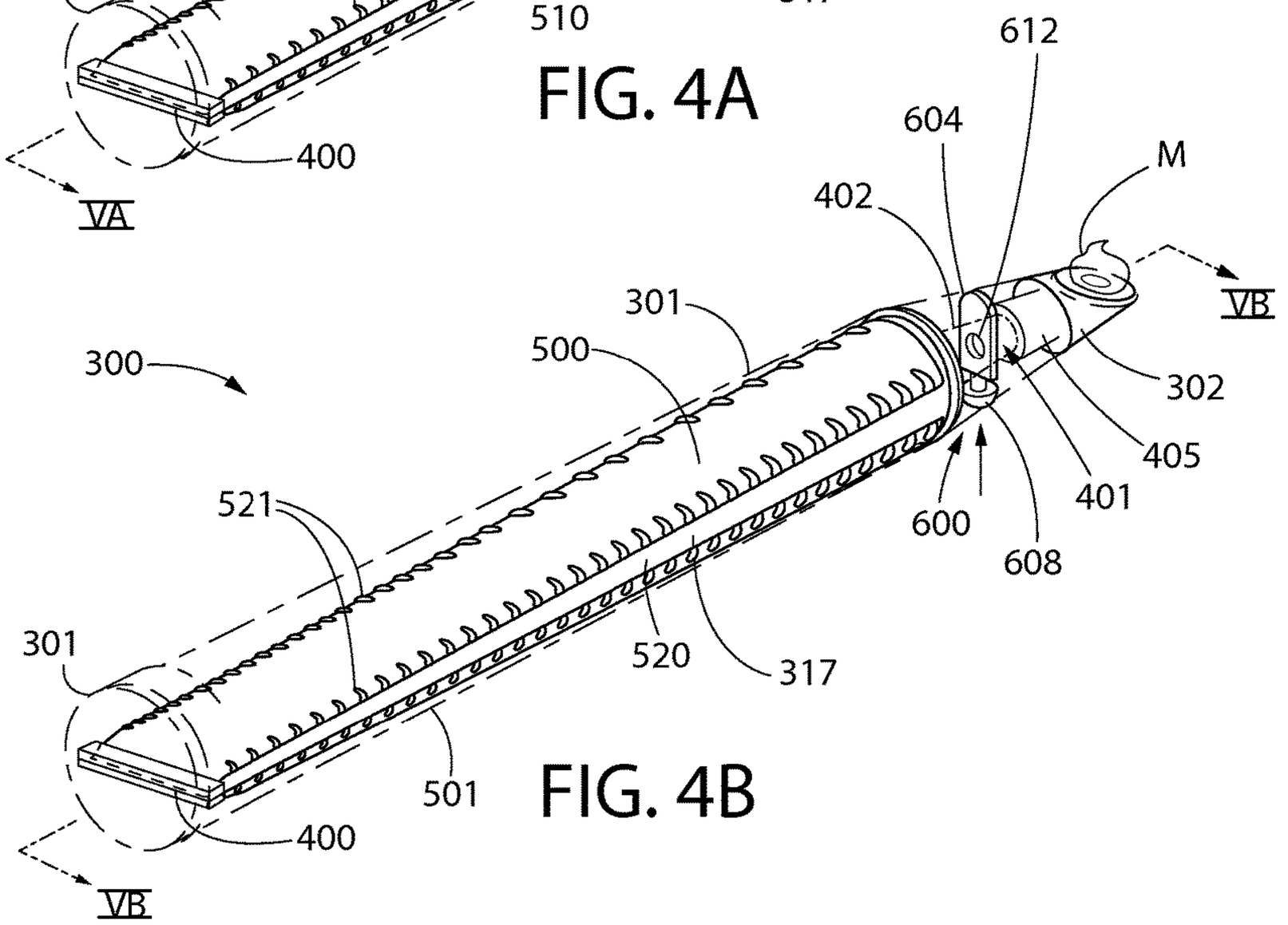
604
404
318
402
301
300
500
VI
VA
302
405
401
521
600
608
VI
301
520
317
510
400
VA

FIG. 4A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405
401
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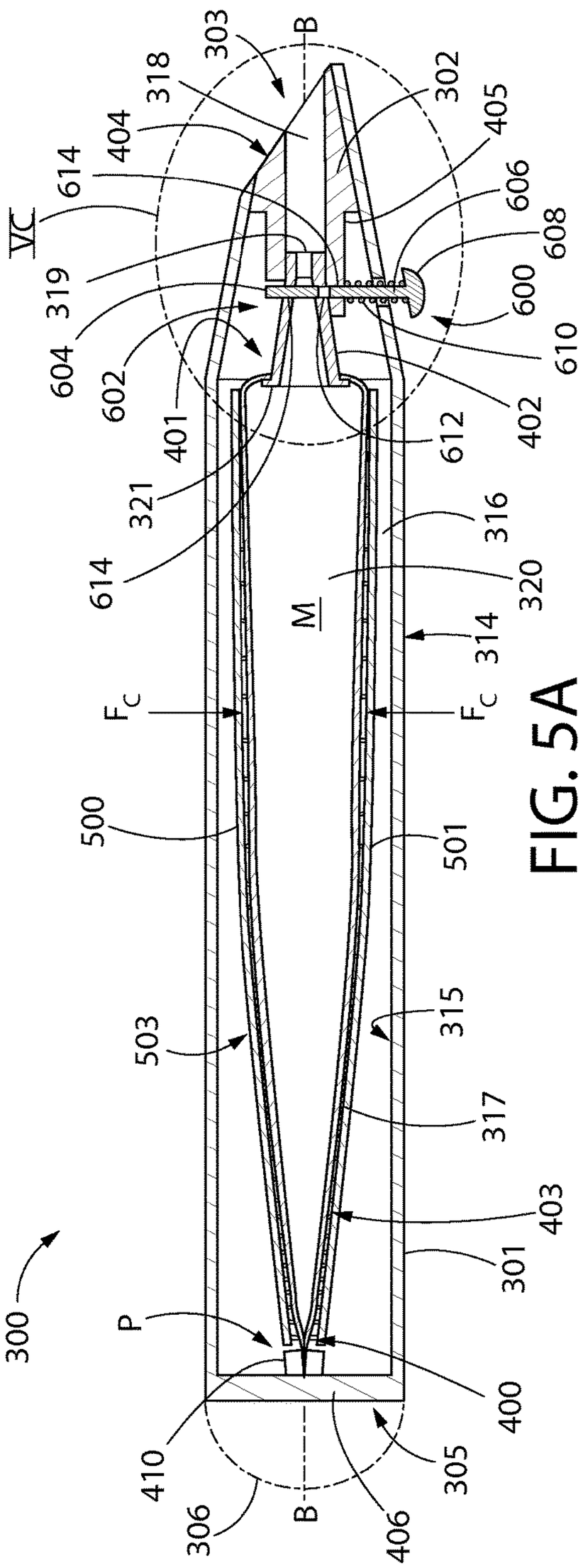
317
301
501
400
VB

FIG. 4B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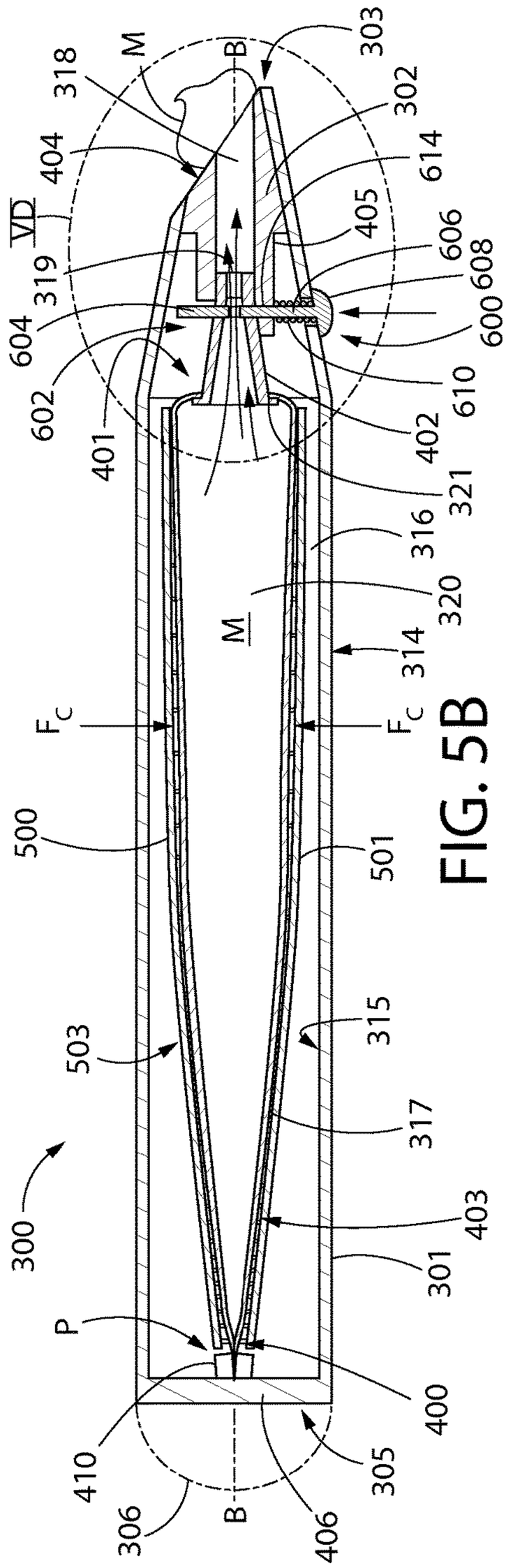
614
404
318
303
B
302
405
606
608
600
610
604
319
602
401
612
402
321
316
M
320
314
F_C
F_C
500
501
503
315
317
403
301
300
P
410
400
306
B
406
305

FIG. 5A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M
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B
404
302
614
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604
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610
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402
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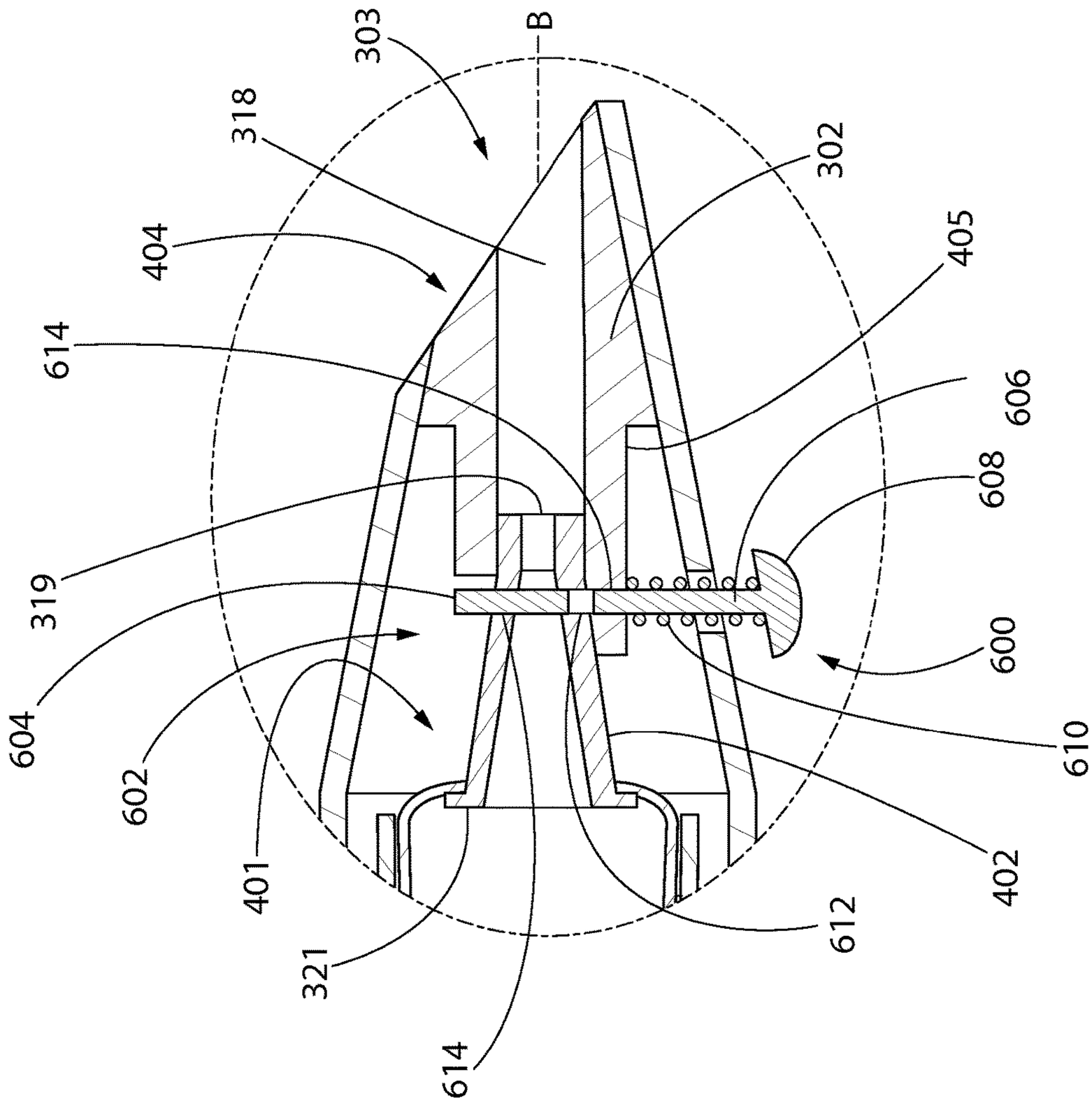
M
320
314
F_C
F_C
500
501
503
315
317
403
301
300
P
410
400
306
B
406
305

FIG. 5B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B
318
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614
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401
321
614
302
405
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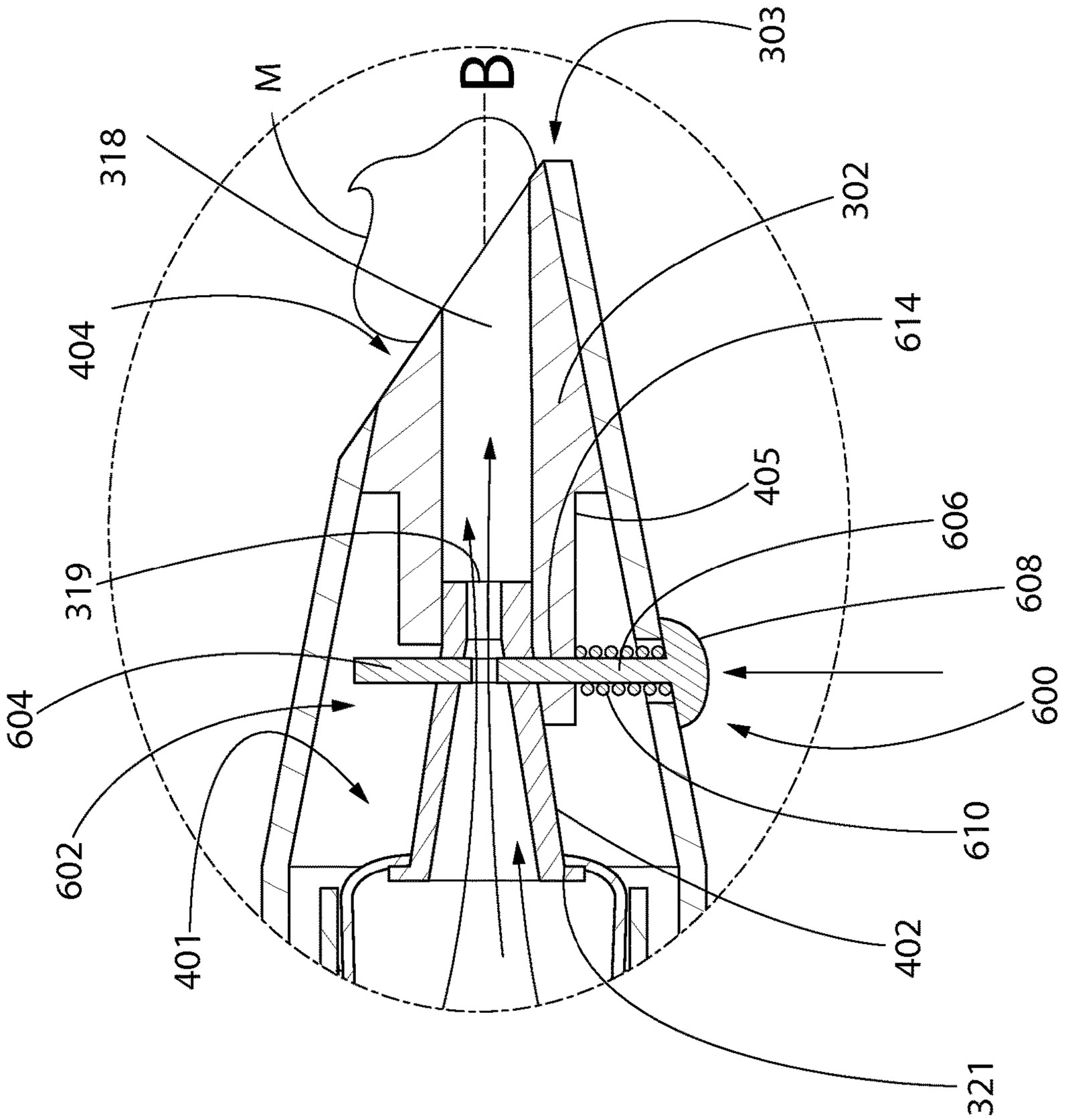
610
402
612

FIG. 5C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402
321

FIG. 5D

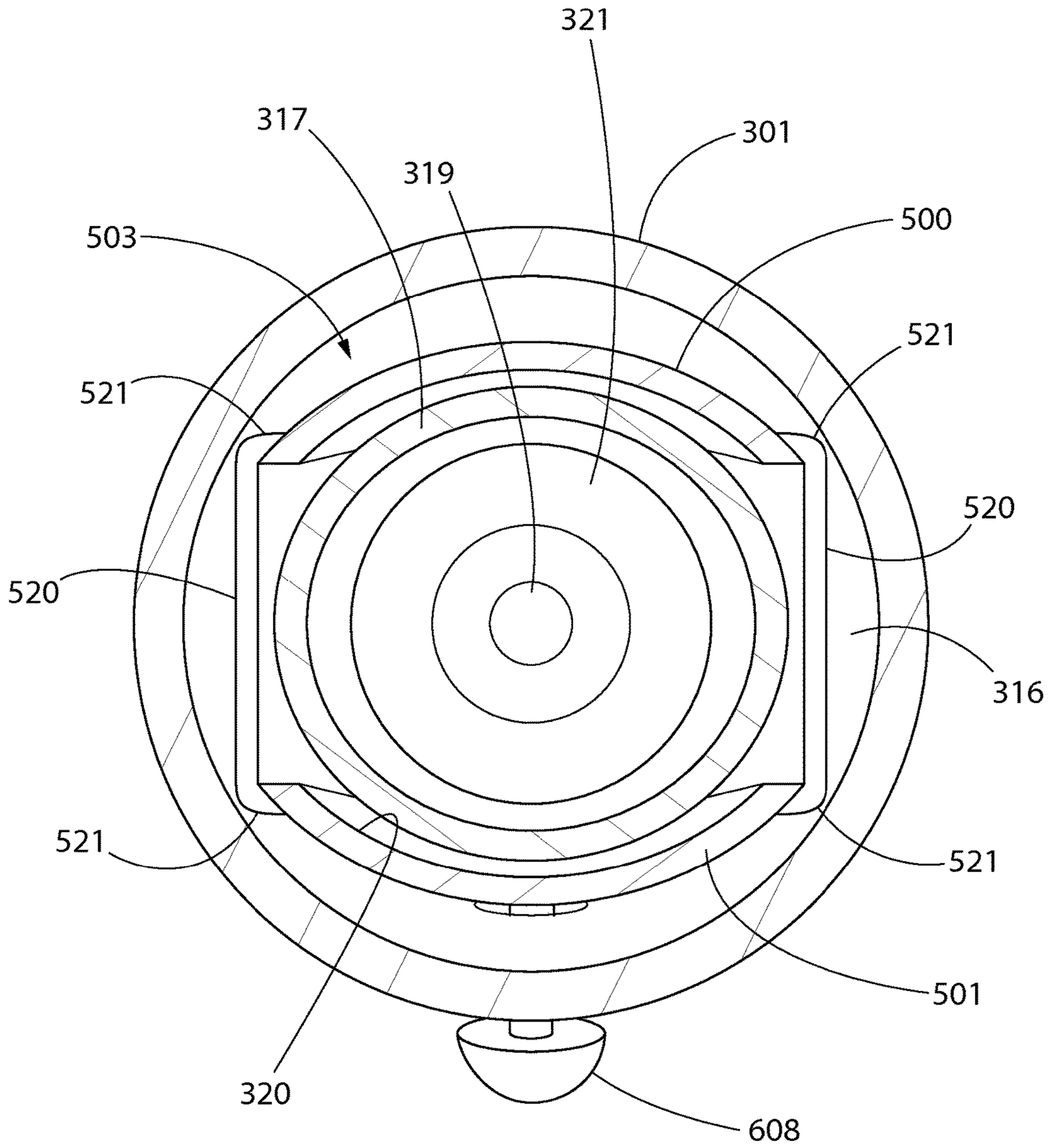
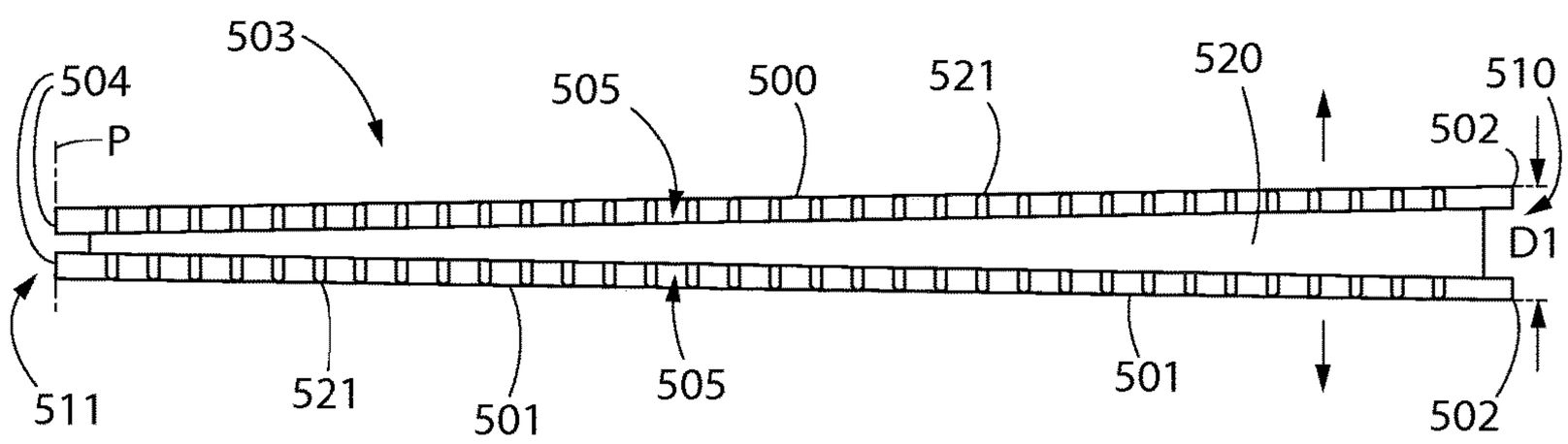


FIG. 6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P
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D1
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501
502

FIG. 7A

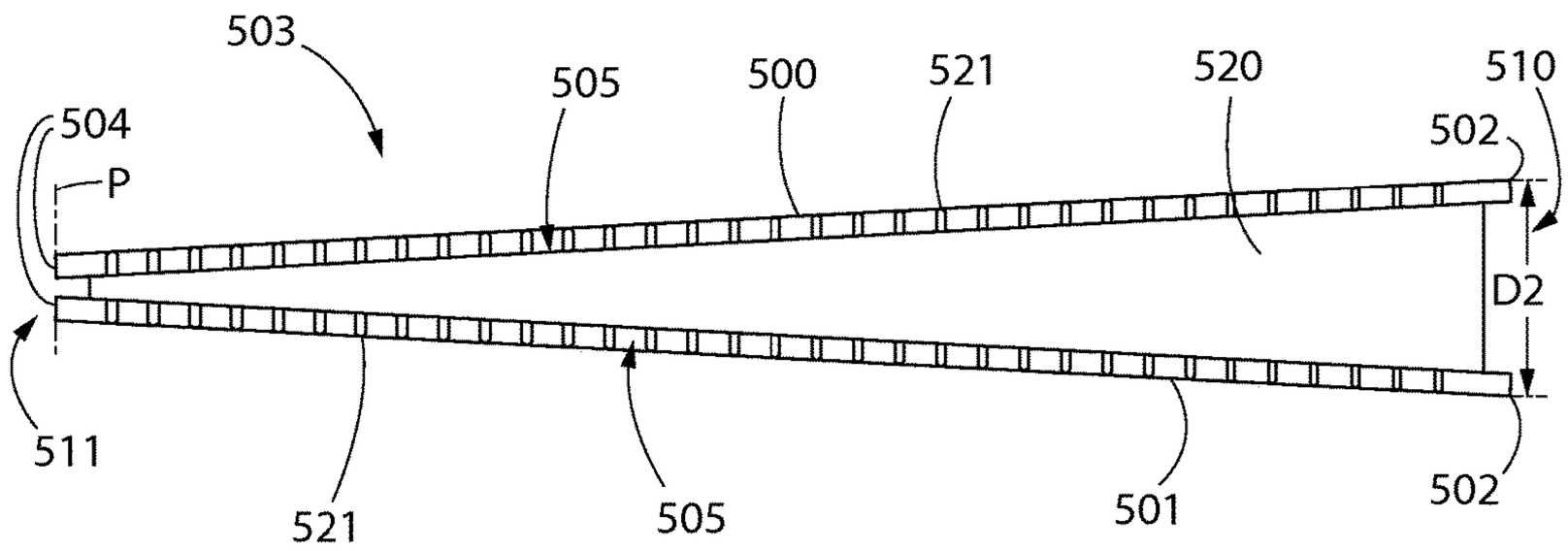
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FIG. 7B

ORAL CARE SYSTEM AND METHOD

BACKGROUND

The present invention relates to oral care systems and related methods, and more particularly to a system and related method including a toothbrush and a detachable dispenser containing a dispensable fluidic oral care material.

Oral care materials or agents may be applied in variety of ways. For tooth whitening products, for example, a common technique used for applying tooth whitening products is to cast an impression of a person's teeth and provide a tray of the shape of this impression. A user then adds a whitening composition to the tray and applies the tray to his/her teeth. The tray is left in place for a period of time and then removed. Another technique is to use a whitening strip that has a whitening composition on one surface. This strip is applied to a person's teeth and left in place for a period of time. Yet another technique is to apply a whitening composition to teeth using a small brush. This brush is repeatedly dipped back into the container during the application of the tooth whitening composition to one's teeth. After a few treatments, the teeth gradually whiten using the foregoing techniques.

The foregoing approaches to oral care material storage, dispensing, and application may not be convenient and readily portable for travel. The oral care product is typically stored separately from the oral care tooth cleaning implements such as a toothbrush and treated as distinct parts of an oral care regimen which must be handled and packed separately.

A more portable, compact, and convenient way to store, dispense, and apply oral care materials to oral surfaces is desired.

BRIEF SUMMARY

According to an embodiment, an oral care material dispenser includes a housing defining a longitudinal axis, a pressurized product tube disposed in the housing and including a reservoir containing an oral care material, an outlet in fluid communication with the reservoir, and a valve fluidly coupled to the outlet. The valve is movable between an open dispensing position and a closed non-dispensing position. The valve is configured to dispense oral care material from the reservoir under pressure when in the dispensing position.

According to an embodiment, an oral care system includes a toothbrush including a head, and a handle coupled to the head and having an internal cavity, a dispenser detachably mounted in the internal cavity of the handle, and a dispenser. The dispenser includes a housing defining a longitudinal axis, a pressurized tube disposed in the housing and including a reservoir containing an oral care material, an outlet in fluid communication with the reservoir, and a valve fluidly coupled to the outlet. The valve is movable between an open dispensing position and a closed non-dispensing position. The valve is configured to dispense oral care material from the reservoir under pressure when in the dispensing position.

A method for dispensing an oral care material is provided. The method includes: providing a dispenser including a housing defining a longitudinal axis, a pressurized product tube disposed in the housing and including a reservoir containing an oral care material, and an outlet in fluid communication with the reservoir and defining a flow path for dispensing the oral care material; engaging opposite sides of the product tube with a compression device operably exerting an inward directed force on the reservoir; actuating a valve fluidly coupled to the outlet of the dispenser and including a flow orifice, the orifice movable into and out of the flow path; positioning the orifice into the flow path; and dispensing the oral care material from the dispenser.

Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

FIG. **1** is a side elevation view of an oral care system including a toothbrush and a fluid dispenser according to one embodiment of the present invention, wherein the dispenser is detachably coupled to the toothbrush;

FIG. **2** is an exploded view thereof;

FIG. **3** is a side cross-sectional view of the toothbrush with dispenser removed;

FIGS. **4**A and **4**B are perspective views of the dispenser with FIG. **4**B showing an oral care material being dispensed;

FIGS. **5**A and **5**B are side cross-sectional views of the dispenser with FIG. **5**B showing an oral care material being dispensed;

FIGS. **5**C and **5**D are enlarged views taken from FIGS. **5**A and **5**B, respectively;

FIG. **6** is a transverse cross-sectional view of the dispenser taken along line VI-VI in FIG. **4**A;

FIG. **7**A is a side elevation view of a compression device of the dispenser in a closed position; and

FIG. **7**B is a side elevation view of the compression device in an open position;

DETAILED DESCRIPTION

The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

As used throughout, ranges are used as shorthand for describing each and every value that is within the range. Any value within the range can be selected as the terminus of the range. In addition, all references cited herein are hereby incorporated by referenced in their entireties. In the event of a conflict in a definition in the present disclosure and that of a cited reference, the present disclosure controls.

Referring to FIGS. **1-3**, an oral care system **100** according to the present invention includes an oral care device such as toothbrush **200** and an oral care material dispenser **300**. In one embodiment, the dispenser **300** may be detachably stored in the toothbrush **200** as further described herein. Because the dispenser **300** is stored within the toothbrush **100**, the oral care system **100** is highly portable for travel, easy to use, and reduces the amount of required luggage space. Furthermore, by housing the toothbrush **200** and dispenser **300** together, the user is less likely to misplace the dispenser **300** and more inclined to maintain the oral treatment routine with the dispenser since brushing will remind the user to simply detach and apply the contents of the dispenser **300** to complete the oral care treatment regimen.

In exemplary embodiments, the oral care material M may include without limitation the following types of flowable compositions in fluid form: tooth whitening, antibacterial, enamel protection, anti-sensitivity, anti-inflammatory, anti-attachment, fluoride, tartar control/protection, flavorant, sensate, colorant and others. However, other embodiments may be used to store and dispense any suitable type of flowable oral care material M. Accordingly, the invention is expressly not limited to any particular type of oral care material M.

With continuing reference to FIGS. **1-3**, the toothbrush **200** has an elongated body and generally includes a handle **210**, a neck **220** and a head **230**. The handle **210** is configured for gripping by a user to manipulate the toothbrush **200** during brushing. In one embodiment, the handle **210** is configured to detachable store the dispenser **300** therein, as further described herein. Handle **210** may be formed of many different shapes, sizes, and materials formed by a variety of manufacturing methods that are well-known to those skilled in the art. If desired, the handle **210** may include a suitable textured grip made of soft elastomeric material. The handle **210** can be a single or multi-part construction. The handle **210** extends axially from a proximal end **212** to a distal end **213** along a longitudinal axis A-A of the toothbrush **200**.

In one embodiment with continuing reference to FIGS. **1-3**, handle **210** is an elongated and at least partially hollow structure defining an internal cavity **280** cooperatively configured with dispenser **300** to allow the dispenser to be detachably housed within the cavity until removed and deployed. An opening **215** is provided at proximal end **212** of the handle **210** that provides a passageway into the cavity through which the dispenser **300** can be inserted and retracted. While the opening **215** is located at the proximal end **212** of the handle **210** in the exemplified embodiment, the opening **215** may be located at other positions on the handle **210** in other embodiments of the invention. For example, the opening **215** may be located on a longitudinal surface of the handle **210** (e.g., the front surface, the rear surface and/or either of the opposing side surfaces) in which case the opening **215** is axially elongated to provide sufficient access to the cavity **280** for inserting the dispenser **300**.

The handle **210** transitions into the neck **220** at the distal end **213**. While the neck **220** generally may have a smaller transverse cross-sectional area than the handle **220**, the invention is not so limited. Broadly speaking, the neck **220** is merely the transition region between the handle **210** and the head **230** and can conceptually be considered as a portion of the handle **210** or a portion of the head **230**. The head **230** and/or neck **220** may therefore be considered as connected to the distal end **213** of the handle **210**.

The head **230** and handle **210** of toothbrush **200** may be formed as a single unitary structure using a molding, milling, machining or other suitable process known in the art. However, in other embodiments, handle **210** and head **230** may be formed as separate components which are operably connected at a later stage of the manufacturing process by any suitable technique known in the art, including without limitation thermal or ultrasonic welding, a tight-fit assembly, a coupling sleeve, threaded engagement, adhesion, or fasteners. Whether the head **230** and handle **210** are of a unitary or multi-piece construction (including connection techniques) is not limiting of the present invention, unless specifically claimed. In some embodiments of the invention, a replaceable type head **230** may be provided which is detachably mounted to the handle **210** (along with a portion of neck **220**) using techniques known in the art, such as disclosed in PCT International Patent Application No. PCT/US2012/042973 filed Jun. 18, 2012, which is incorporated herein by reference in its entirety.

Head **230** generally includes a front surface **231**, a rear surface **232** and a peripheral side surface **233** that extends between the front and rear surfaces **231**, **232**. The front surface **231** of the head **230** includes a plurality of oral cleaning elements such as tooth engaging elements **235** extending therefrom for cleaning and/or polishing contact with an oral surface and/or interdental spaces. While the tooth engaging elements **235** are suited for brushing teeth, the tooth engaging elements **235** can also be used to polish teeth instead of or in addition to cleaning teeth. As used herein, the term "tooth engaging elements" is used in a broad generic sense to refer to any structure that can be used to clean, polish or wipe the teeth and/or soft oral tissue (e.g. tongue, cheek, gums, etc.) through relative surface contact. Common examples of "tooth engaging elements" include, without limitation, bristle tufts, filament bristles, fiber bristles, nylon bristles, spiral bristles, rubber bristles, elastomeric protrusions, flexible polymer protrusions, combinations thereof and/or structures containing such materials or combinations. Suitable elastomeric materials include any biocompatible resilient material suitable for uses in an oral hygiene apparatus. To provide optimum comfort as well as cleaning benefits, the elastomeric material of the tooth or soft tissue engaging elements has a hardness property in the range of A8 to A25 Shore hardness. One suitable elastomeric material is styrene-ethylene/butylene-styrene block copolymer (SEBS) manufactured by GLS Corporation. Nevertheless, SEBS material from other manufacturers or other materials within and outside the noted hardness range could be used.

Tooth engaging elements **235** of the present invention can be connected to the head **230** in any manner known in the art. For example, staples/anchors, in-mold tufting (IMT) or anchor free tufting (AFT) could be used to mount the cleaning elements/tooth engaging elements. In AFT, a plate or membrane is secured to the brush head such as by ultrasonic welding. The bristles extend through the plate or membrane. The free ends of the bristles on one side of the plate or membrane perform the cleaning function. The ends of the bristles on the other side of the plate or membrane are melted together by heat to be anchored in place. Any suitable form of cleaning elements may be used in the broad practice of this invention. Alternatively, the bristles could be mounted to tuft blocks or sections by extending through suitable openings in the tuft blocks so that the base of the bristles is mounted within or below the tuft block.

Toothbrush **200** and the dispenser **300** are non-unitary separate structures that are specially designed and configured to be detachably coupled together when in an assembled state (referred to herein as a "storage state") and completely isolated and separated from one another when in a disassembled state (referred to herein as an "application state"). The toothbrush **200** and the dispenser **300** are illustrated in the storage state in FIG. **1** and in the application state in FIG. **2**. The dispenser **300** can be slidably manipulated and altered between the storage state (FIG. **1**) in which the dispenser **300** is located (or docked) in the toothbrush handle **210** and the application state (FIG. **2**) in which the dispenser **300** is removed from the handle **210** by the user as desired.

FIGS. **4**A-B and **5**A-B illustrate one non-limiting embodiment of a dispenser **300** accordingly to the present invention. Dispenser **300** may be an elongated tubular pen-like structure that extends along a longitudinal axis B-B. The dispenser **300** comprises an elongated housing **301**, an appli-

cator **302** located in and closing an open distal end **303** of the housing **301**, and a proximal end **305** of the housing **301**. Distal end **303** may be considered to define a forward end or location and proximal end **305** may be considered to define a rear end or location of dispenser **300**. The distal end **303** portion of dispenser **300** may be frusto-conical shaped in some embodiments.

Housing **301** may be a generally circular transverse cross-sectional profile in one embodiment. Of course, in other embodiments, the transverse cross-sectional profile of the housing **301** can take on various non-circular shapes. The housing **301** is constructed of a material and with a wall thickness that is sufficiently rigid to provide the necessary structural integrity and stiffness for handling and dispensing of an oral care material M from the dispenser **300** without substantial deformation. For example, the housing **301** can be formed of a moldable hard plastic. Suitable hard plastics include polymers and copolymers of ethylene, propylene, butadiene, vinyl compounds and polyesters such as polyethylene terephthalate. Others may be used and the invention is not limited to any particular material of construction.

While the housing **301** is exemplified as a single layer construction, in certain embodiments, the housing **301** may be a multilayer construction. In certain multi-layer embodiments, an inner layer can be formed from the hard plastic materials described immediately above while an outer layer can be formed of a soft resilient material, such as an elastomeric material. Suitable elastomeric materials include thermoplastic elastomers (TPE) or other similar materials used in oral care products. The elastomeric material of the outer layer may have a hardness durometer measurement ranging between A13 to A50 Shore hardness, although materials outside this range may be used. A suitable range of the hardness durometer rating is between A25 to A40 Shore hardness. While an over-molding construction is one suitable method of forming the outer layer, a suitable deformable thermoplastic material, such as TPE, may be formed in a thin layer and attached to inner layer with an appropriate adhesive, sonic welding, or by other means.

Housing **301** of dispenser **300** is an elongated hollow tubular structure extending along the longitudinal axis B-B from the proximal end **305** to the distal end **303**. The housing **301** comprises an outer surface **314** and an inner surface **315** that forms an elongated internal chamber **316** for housing a pressurized product tube **317** containing an oral care material M. In one embodiment, proximal end **305** may be open before closure by end cap **306** attached thereto, thereby providing access to chamber **316** for insertion of the collapsible and squeezable product tube **317** with oral care material M. Proximal end **305** may further be closed by an end wall **406**.

With continuing reference to FIGS. **4**A-B and **5**A-B, product tube **317** is axially elongated extending from proximal end **305** to the distal end **303** of dispenser housing **301**. A first proximal end **400** of the tube may be sealed by a suitable means such as without limitation heat sealing, crimping, ultrasonic welding, adhesives, or other. An opposing second distal end **401** of the product tube may be terminated with a nozzle **402**. The nozzle **402** may include a base **321** connected and sealed to the main body of the tube at distal end **401**. Nozzle **402** includes an internal flow conduit **620** and terminal opening **319** forming a flow path for dispensing the oral care material M from the product tube **317**. The product tube **317** includes flexible deformable sidewalls **403** extending circumferentially around the tube which are structured to be compressed and collapsed by a compression device **503** for dispensing oral care material M, as further described herein. Sidewalls **403** are constructed to hold the contents of the product tube **317** under a positive pressure.

The sidewalls **403** define an internal reservoir **320** holding a volumetric amount of the oral care material M. In an undeformed state filled with oral care material M, sidewalls **403** of product tube **317** may be approximately circular in transverse cross-sectional shape at least in the middle and nozzled distal end **401** sections of the tube. The product tube **317** may assume a more flattened somewhat rectangular shape near the closed proximal end **400** (see, e.g. FIGS. **5**A-B). Other cross-sectional collapsible tube shapes, however, may be provided which are useable with embodiments of the present invention.

Product tube **317** may be made of any suitable flexible material useable for forming squeeze tubes, such as without limitation extruded plastic squeeze tubes formed of HDPE (high density polyethylene) or LDPE (low density polyethylene). Other resilient polymers may be used.

Product tube **317** is filled with a desired flowable oral care material M, which can contain any active oral care agent and/or inactive ingredients. The oral care agent and/or its carrier may be in any form of a fluidic or flowable material including without limitation viscous pastes/gels or less viscous liquid compositions. Any suitable oral care material M can be stored in product tube **317** and used in the present invention. For example, the oral care material M may include any oral care agents such as without limitation oxidative or whitening agents with peroxide-containing chemical compositions which are well known in the art. Other contemplated fluidic oral care materials useable with the present invention include, without limitation: antibacterial agents; enamel strengthening or repair agents; tooth erosion preventing agents; anti-sensitivity ingredients; gum health actives; nutritional ingredients; tartar control or anti-stain ingredients; enzymes; sensate ingredients; flavors or flavor ingredients; breath freshening ingredients; oral malodor reducing agents; anti-attachment agents or sealants; diagnostic solutions; occluding agents; anti-inflammatory agents; dry mouth relief ingredients; catalysts to enhance the activity of any of these agents; colorants or aesthetic ingredients; dentifrice or toothpaste; and combinations thereof. In some embodiments, the oral care material M does not contain dentifrice or toothpaste and is instead contains active agents or ingredients that provide supplemental oral care benefits in addition to merely brushing one's teeth. Other suitable fluids could include lip balm or other similar materials that are typically available in a highly viscous semi-solid yet flowable state that may be extruded from collapsible bladder **317**, as further described herein.

With continuing reference to FIGS. **4**A-B and **5**A-B, applicator **302** may include a dispensing passageway **318** through which the oral care material M stored in product tube **317** can be dispensed from the dispenser **300**. Passageway **318** and the internal flow conduit **620** of the product tube nozzle **402** collectively define an outlet for dispensing the oral care material M. In one embodiment, dispensing passageway **318** is elongated and extends axially through applicator **302** thereby forming a fluid conduit that is in fluid communication with product tube **317** and nozzle **402** for receiving and discharging the oral care material M to the oral surfaces of the user or toothbrush **200** (e.g. toothpaste). In one embodiment, the dispensing passageway **318** may be located in a transversely angled or slanted exposed forward end wall **404** of applicator **302**. End wall **404** defines an exposed surface and is angled forward in relation to the longitudinal axis B-B, which facilitates the application of

the oral care material M to the teeth, gums, lips, or other oral surfaces. The rear of applicator **302** includes a rear or proximally projecting tubular socket **405** configured for insertion of nozzle **402** from product tube **317** as shown. Tubular socket **405** fluidly and mechanically couples the product tube to the applicator **302**. Socket **405** has a central axial passageway which is in fluid communication with nozzle **402** on collapsible bladder **317** and passageway **318**. Other suitable ways of coupling nozzle **402** to applicator **302** are possible.

In certain alternative embodiments using a liquid and low viscosity oral care material M fluid, a porous applicator **302** may be provided which is constructed of a material that supports capillary fluid transport. Various porous polymeric foams or other suitable capillary materials may be used. In such embodiments, dispensing passageway **318** may be omitted as the entire porous applicator will conduct the fluidic oral care material M from the product tube nozzle **402** to the exposed surface on front wall **404** for application to the target oral tissue. Furthermore, in certain other embodiments, the dispensing passageway **318** can be located in other areas of the housing **301**, such as on one of the longitudinal side walls of the dispenser **300** and/or applicator **302**. In some embodiments, a plurality of dispensing passageways **318** can be provided. For example, the plurality of dispensing passageways **318** can be provided in a generally circular configuration that may be used to facilitate the fluid being dispensed through the applicator **302**.

In one embodiment, applicator **302** may be formed of a soft resilient material, such as an elastomeric material. Suitable elastomeric materials include thermoplastic elastomers (TPE) or other similar materials used in oral care products. The elastomeric material of the outer layer may have a hardness durometer measurement ranging between A13 to A50 Shore hardness, although materials outside this range may be used. A suitable range of the hardness durometer rating is between A25 to A40 Shore hardness.

In alternative embodiments, the applicator **302** may be constructed of bristles, a porous or sponge material, or a fibrillated material. Suitable bristles include any common bristle material such as nylon or PBT. The sponge-like materials can be of any common foam material such as urethane foams. The fibrillated surfaces can be comprised of various thermoplastics. The invention, however, is not so limited and the applicator **302** can be any type of surface and/or configuration that can apply a viscous substance onto the hard surface of teeth, including merely an uncovered opening/passageway.

The applicator **302** may have a generally circular transverse cross section fitted at least partially into open distal end **303** of dispenser **300**. Applicator **302** may be flushed mounted with the distal end **303** of dispenser **300** in some embodiments as shown in FIGS. **4**A-B and **5**A-B. In other embodiments, the applicator protrudes beyond the front end surfaces of the dispenser **300**. Either arrangement may be used.

Referring to FIGS. **4**A-B and **5**A-B, proximal end **305** of dispenser housing **301** may have any suitable configuration. In one embodiment, open proximal end **305** may be closed by a rear end wall **406**. End wall **406** may be flat in one embodiment, or have another suitable configuration in other embodiments including angled, curved, or other. The end wall **406** may be constructed to be inserted into open end **305** of housing **301** after insertion of the collapsible bladder **317**. The end wall **406** may be a separate unitary structure or in other embodiments be an integral unitary part of end cap **306** which is affixed to the proximal end **305** of the dispenser housing **301** (see also FIGS. **1** and **2**).

End wall **406** of dispenser housing **301** may optionally be configured to include a clamping member **410** disposed on an interior surface inside internal chamber **316** of the dispenser **300**. Clamping member **410** may have a horizontally split structure with upper and lower halves configured to grip opposing sides of the proximal end **400** of product tube **317**. This holds the tube in position during dispensing of the oral care material M from the tube via compression device **503**. In some embodiments, clamping member **410** may be configured to also engage the proximal ends **509** of upper and lower pressure plates **500**, **501** of the compression device **503** with the proximal end **400** of product tube **317** being sandwiched therebetween. In one embodiment, the proximal end **400** of product tube **317** and/or pressure plates **500**, **501** may be releasably affixed to end wall **406** of dispenser housing **301**. It will be appreciated that in other embodiments, clamping member **410** may be omitted.

The compression device **503** and the oral care material M dispensing mechanism will now be further described with reference to FIGS. **4**A-B, **5**A-B, and **6**.

Compression device **503** provides a compression mechanism configured to engage product tube **317** for automatically dispensing oral care material M from the **317**. In one embodiment, compression device **503** includes an open front end **510**, closed rear end **511**, and an opposing pair of an upper pressure plate **500** and lower pressure plate **501** operably and resiliently coupled together. Each pressure plate **500**, **501** is axially elongated and may be arcuately shaped in transverse cross section. In other embodiments, the plates may have straight cross sectional shape. The pressure plates **500**, **501** are configured and operable to simultaneously engage opposing sidewalls **403** of product tube **317**. This applies an inward directed compressive force Fc which places the contents of the product tube **317** (e.g. oral care material M) under a continuous positive pressure and ready for dispensing.

Each pressure plate **500**, **501** includes a distal end **502**, proximal end **504**, and pair of axially extending longitudinal edges **505** defining an elongated longitudinally extending compartment **506** configured for insertion of product tube **317** between the plates. In one embodiment, the proximal ends **504** of the pressure plates **500**, **501** are disposed proximate to each other and may be abutting. The distal ends **502** may be spaced apart to define the open front end **510** of the compression device **503** through which the product tube **317** may be axially inserted. Longitudinal edges **505** may have any suitable shape including straight. In one embodiment, the edges **505** may be ridged or scalloped.

The upper and lower compression pressure plates **500**, **501** of compression device **503** may be formed of any suitable rigid material, including moldable hard plastic or metal. Injection molded hard plastics that may be used include polymers and copolymers of ethylene, propylene, butadiene, vinyl compounds and polyesters such as polyethylene terephthalate. Others materials may be used and the invention is not limited to any particular material of construction. Each pressure plate **500**, **501** may be one piece having a unitary construction.

In one embodiment, the upper pressure plate **500** and lower pressure plate **501** may be resiliently coupled together by a pair of longitudinally extending elastomeric members **520**. Each elastomeric member **520** is configured to engage mating opposing longitudinal edges **505** of upper and lower pressure plates **500**, **501** along the lateral sides of the compression device **503**. Elastomeric members **520** may

each be continuous in structure and extend axially between the distal and proximal ends **502**, **504** of the pressure plates **500**, **501** without interruption for the entire length or nearly the entire length of the plates (see, e.g. FIGS. **4**A-B). In other embodiments, the elastomeric members **520** may be spaced intermittently along the longitudinal edges **505** of the pressure plates **500**, **501** forming an interrupted and discontinuous pattern. This latter construction is possible because the oral care material M is disposed inside product tube **317**.

The elastomeric members **520** are deformable and stretchable by application of a force. Elastomeric members **520** have an elastic memory which returns the members to a non-deformed condition when the force is removed. Any suitable resilient material having an elastic memory may be used. In one non-limiting embodiment, the elastomeric members **520** may be made of thermoplastic elastomers (TPE). Preferably, the material selected for elastomeric members **520** has a tensile strength and tear properties suitable to allow the material to be stretched through a desired range of deformation in operation without breaking or experiencing excessive compression set (i.e. permanent deformation).

In one embodiment, each elastomeric member **520** may include a plurality of integrally formed elongated resilient anchors **521** permanently attached to the upper and lower pressure plates **500**, **501** along opposite lateral sides of the plates. In one arrangement, the anchors **521** are attached along the longitudinal edges **505** of the pressure plates **500**, **501**. The anchors **521** may have a transversely elongated finger-like construction and configuration; however, other configurations of anchors **521** may be used. An upper and lower opposing row of anchors **521** may be provided for each elastomeric member **520** with the anchors in each row being are oriented transversely to the longitudinal axis B-B and extending in opposing transverse directions. Other suitable arrangements of anchors **521** may be used.

Anchors **521** form anchor points for attaching each elastomeric member **520** to an upper and lower pressure plate **500**, **501** to resiliently couple the plates together along their longitudinal edges **505**. Because the anchors **521** each have smaller axial width (measured along longitudinal axis B-B) than an entire elastomeric member **520**, they are more resilient and stretchable in the transverse direction when the pressure plates **500**, **501** are transversely pulled or pushed apart, as further described herein. In one embodiment, the anchors **521** may be spaced at intervals axially along a majority or substantially the entire length of the pressure plates **500**, **501** as shown. Any suitable number of anchors **521** may be provided.

While an over-molding construction is one method that may be used for attaching the anchors **521** of the elastomeric members **520** to the upper and lower pressure plates **500**, **501**, other suitable methods may be used such as an appropriate adhesive, sonic welding, or others. It will also be appreciated that in other possible embodiments, the anchors **521** may be formed separately from the elastomeric members **520** and attached thereto by any suitable means, such as adhesives, sonic welding, or others.

In operation, the upper and lower pressure plates **500**, **501** of compression device **503** are pivotably and resiliently movable apart and together in relation to each other about a pivot point P, as shown in FIGS. **7**A and **7**B. The pivot point P may be formed at proximal end **400** of the product tube **317** by the proximal ends **504** of the pressure plates **500**, **501** which are disposed in close proximity to each other. FIG. **7**A shows the compression device **503** and pressure plates **500**, **501** in a closed unbiased position. The longitudinal edges **505** of each pressure plates **500**, **501** are disposed proximate to each other. This is particularly noticeable at the distal ends **502** and adjoining longitudinal edges **505** of each pressure plate which are in close proximity. In the unbiased position, the distal ends **502** are transversely spaced apart by a distance D**1**. The elastomeric members **520** along each lateral side of the pressure plates **500**, **501** are not stretched or deformed being in an inactive relaxed condition.

When a filled product tube **317** is positioned at least partially between the pressure plates **500**, **501** (see, e.g. FIGS. **4**A-B), the plates are each transversely displaced and resiliently spread apart in relation to each other. FIG. **7**B shows the compression device **503** and pressure plates **500**, **501** in this open biased position being spread apart against the biasing force of elastomeric members **520** which acts to pull the plates back together. The longitudinal edges **505** of each pressure plates **500**, **501** are now disposed more distally to each other than in the closed position (compare to FIG. **7**A). The distal ends **502** of the pressure plates **500**, **501** are transversely spaced apart by a second distance D**2** which is larger than first distance D**1**. The diameter of open front end **510** of compression device **503** has also changed from a first diameter associated with the closed position to a larger second diameter associated with the open position. Notably, the elastomeric members **520** along each lateral side of the pressure plates **500**, **501** have deformed and are transversely stretched in an active stretched condition. The elastic memory of the elastomeric members **520** biases the pressure plates **500**, **501** back towards the closed position, thereby exerting an inward compressive force Fc against opposing sidewalls **403** of the product tube **317**. This operates to automatically extrude and dispense oral care material from the product tube **317**.

To control and regulate dispensing of oral care material M from product tube **317**, an actuator mechanism **600** is provided. In one embodiment shown in FIGS. **4**A-B and **5**A-B, the actuator mechanism **600** may include a valve **602** comprising a plug **604**, a stem **606** operably coupled to the plug, and an operating button **608** with biasing spring **610** operably coupled to the stem on one end and configured to be depressed by a user for dispensing oral care material M. In the exemplified embodiment, the operating button **608** extends from a side of the dispenser housing **301** that is opposite the facing direction of the end wall **404** of the applicator **302**. This can be beneficial so that the user's hands and fingers are kept out of the way when the operating button **608** is being depressed and the applicator is positioned in or near a user's mouth for direct application of the oral care material M to the user's teeth or other oral surfaces. Of course, the invention is not to be so limited in all embodiments and the operating button **608** can be positioned at other locations on the dispenser housing **301** as desired.

The plug **604** includes a portion movably and slideably disposed in nozzle **402** to intercept the flow path of oral care material M between the distal end **401** of product tube **317** and terminal opening **319**. In one non-limiting embodiment, the valve **602** may be a gate valve and plug **604** may be configured as a generally flat plate as shown. Other suitable types and configurations of valves and plugs may be provided. The plug **604** is slideably inserted through a pair of diametrically opposed transverse slots **614** formed through the top and bottom of the nozzle **402**. The plug **604** may be configured to slide through both the top and bottom slots **614** such that the upper end of the plug may protrude upwards through the top slot and nozzle **402** (see, e.g. FIGS. **5**A and **5**B). A relatively snug fit and/or seals may be provided between the plug **604** and nozzle slots **614** to prevent oral

care material M from leaking into the interior of dispenser housing **301** from the nozzle **402**.

Plug **604** further includes a flow orifice **612** which is transversely movable into and out of the nozzle **402** and its interior flow path for the oral care material M which is axially oriented along longitudinal axis B-B. In one embodiment, the orifice **612** may be disposed between the upper and lower ends of the plug **604** The actuator **600**/valve **602** is movable between an open dispensing position wherein oral care material M is dispensed from product tube **317** when the orifice **612** is positioned inside the nozzle **402**, and a closed non-dispensing position wherein oral care material M is blocked from being dispensed when the orifice is positioned outside at least the interior flow path through the nozzle. Because the contents of the product tube **317** are under pressure created by compression device **503** as described herein, oral care material M will be automatically dispensed when a user depresses operating button **608** (inwards against the force of spring **610** which is compressed) to activate the actuator **600**. This moves the orifice **612** into concentric alignment with the nozzle **403** corresponding to the open dispensing position of actuator **600**/valve **602**, as shown in FIG. **5**B. The spring **610** normally biases the operating button **608** into a projected outward position corresponding to the closed non-dispensing position of actuator **600**/valve **602**, as shown in FIG. **5**A.

In one embodiment, the components of valve **602** may be disposed inside distal end **303** of the dispenser housing **301** except for operating button **610** and adjoining portion of stem **606** which extends through the housing. The valve components may be made of any suitable materials, such as plastic (with possible exception of spring **610** which may be formed of spring steel). In one embodiment, the plug **604** and stem **606** may be of integral unitary construction.

In alternative or additional embodiments, the valve **602** may be located in dispenser **300** such that the plug **304** with flow orifice **614** is slideably insertable through the fluid passageway **318** in applicator **302** instead of the internal flow conduit **620** inside the product tube nozzle **402**. In either construction, the plug **604** is operable to intercept and interrupt the flow of oral care product M from the tube **317** and dispenser **300** to prevent unintentional dispensing.

A method for dispensing oral care material M from dispenser **300** will now be summarized from the foregoing description. A dispenser **300** is first provided which is filled with oral care material M. The compression device **503** and pressure plates **500**, **501** are in the open position shown in FIG. **7**B. In this position, the pressure plates **500**, **501** actively apply an inward directed compressive force Fc against the product tube **317** (i.e. sidewalls **403**) and place its contents under pressure. The actuator **600**/valve **602** is in the closed non-dispensing position shown in FIG. **5**A wherein oral care material M is blocked from being dispensed by plug **604** of the valve **602**. Operating button **608** is not depressed and actuated. The valve flow orifice **612** is not fully inserted into product tube nozzle **402** such that the flow path of oral care material M through the nozzle is blocked by a solid portion of valve plug **604** to prevent dispensing the material. Accordingly, the flow orifice **612** is not axially aligned with the flow path of oral care material M through the nozzle **402** and passageway **318**.

To dispense oral care material M, a user depresses operating button **608** to active the actuator (see directional arrow). This in turn linearly translates the plug **604** of valve **602** in a first transverse direction, thereby further slideably inserting the plug through nozzle **402** to position and axially align flow orifice **612** inside the nozzle in the flow path of oral care material M, as shown in FIG. **5**B. The actuator **600**/valve **602** is now in the open dispensing position allowing oral care material M under pressure in product tube **317** to be dispensed by the valve **602**. In certain embodiments, the pressure is a constant pressure regardless or irrespective of the amount of oral care material M within the product tube **317** so that a predetermined amount of the oral care material M is dispensed per unit time regardless of the amount of oral care material M remaining. Of course, the invention is not to be so limited in all embodiments and in certain other embodiments the pressure can be variable based upon the amount of oral care material M within the product tube **317**.

When the actuator **600**/valve **602** is in the open dispensing position, the compression device **503** squeezes and pushes the oral care material M inside product tube **317** forward and distally towards nozzle **402**. The oral care material M now freely flows through valve flow orifice **612** and nozzle **402** into dispensing passageway **318**, and then outwards from the applicator **302** for delivery to the target oral surfaces or an oral care implement such as toothbrush **100**. With each dispensing action, the pressure plates **500**, **501** move farther and farther towards the closed position shown in FIG. **7**A under the biasing effect of elastomeric members **520** which pull the plates back together.

During the foregoing dispensing action, it should be noted that the user may hold the operating button **608** inwards to continue to dispense a desired quantity of oral care material M. Releasing the operating button causes the valve **602** to automatically close under the biasing action of spring **610** and stop dispensing oral care material. This linearly translates the plug **604** of valve **602** in a second opposite transverse direction, thereby slideably removing the flow orifice **612** from inside the nozzle **402** and the flow path of oral care material M, as shown in FIG. **5**A. In certain embodiments, the spring **610**-stem **606** assembly may be lubricated with a low viscosity lubricant for slow return of the valve **602** to the closed non-dispensing position. Advantageously, this allows a user to quickly depress and release the operating button **608**, thereby dispensing a predetermined dosage of oral care material M while the flow orifice **612** remains positioned inside the product tube nozzle **402**. Any mode of operation is acceptable depending on the quantity of oral care material M that the used desires to dispense.

It will be appreciated that other forms of compression devices **503** beside the non-limiting exemplary embodiment disclosed herein may be used to pressurize the contents of product tube **317**. For example, the internal chamber **316** of dispenser housing **301** may be hermetically sealed and pressurized with an inert gas at a suitable positive pressure to exert the inward compressive force Fc on the product tube **317**. Other forms of elastomeric members **520** may be used or alternatively variously configured mechanical spring elements may be provided that are configured and arranged to maintain the product tube contents in a relatively continuous pressurized state. Accordingly, the compression device is not limited by the form or configuration of the device disclosed herein. The term "continuous" as used herein with respect to the pressure maintained in the product tube is intended to connote the tube contents are maintained under pressure, recognizing that the pressure may gradually decrease as the oral care material is dispensed over time.

The process of detaching and reattaching the dispenser from the toothbrush **200** will now be described. Referring initially to FIG. **1**, the dispenser **300** is illustrated in the storage state. When in the storage state, the dispenser **300** is

docked within the cavity **280** of the handle **210** of the toothbrush **200**. An interference fit between the outer surface **314** of the dispenser **300** and an inner surface **240** of the toothbrush **200** that forms the cavity **280** detachably couples and retains the dispenser **300** to the toothbrush **200**. When the dispenser **300** is in the storage state, at least a portion, and preferably a majority, of the dispenser **300** is located within the internal cavity **280** of the toothbrush **200**. The end cap **306** preferably exposed and outside of internal cavity **280** to be grasped by a user for axially withdrawing the dispenser **300** from the cavity.

In certain embodiments, the handle **210** of the toothbrush **200** will have a feature that enables the operating button **608** to fit within the cavity **280**. Specifically, the inner surface **240** of the toothbrush **200** may include a slot or channel that receives the operating button **608** when the dispenser **300** is slidably inserted into the cavity **280** so that the operating button **608** is not depressed when the dispenser **300** is in the storage state. Such a slot or channel may extend from the proximal end **212** of the handle **200** a distance into the cavity **280** sufficient to enable the operating button **608** to slide within the slot or channel through the entire distance that the operating button **608** extends into the cavity **280**.

In the exemplified embodiment, the entirety of the housing **301** of the dispenser **300**, including the applicator **302**, are located within the cavity **280** of the toothbrush **200** when the dispenser **300** is in the storage state. The end cap **306** of the dispenser **300**, however, protrudes axially from the proximal end **212** of the handle **210** of the toothbrush **200**. This allows a user to readily grasp, axially withdraw, and deploy the dispenser. In one embodiment, the end cap **306** may be dome shaped continues the natural curved contour of the handle **210**. This conceals the dispenser **300** and provides a rounded proximal end to the oral care system **100**, thereby providing a look that aesthetically resembles a traditional manual toothbrush. It will be appreciated that other suitable end cap **306** shapes may be provided.

To remove the dispenser **300** in the application state shown in FIG. **2**, the user merely grasps end cap **306** and axially withdraws the dispenser from internal cavity **280** of toothbrush **200**. With the dispenser **300** now undocked from toothbrush handle **210**, the user may dispense the oral care material M in the manner described above by axially advancing the compression device assembly **500** towards the distal end **303** of the dispenser **300**. When finished, the user may then axially reinsert the dispenser **300** into internal cavity **280** of toothbrush **200**. In one embodiment, an axially elongated sealing plug **530** may be disposed near the distal end of toothbrush internal cavity **280** to help seal the dispensing passageway **318** in applicator **302** when the dispenser **300** is docked in the toothbrush handle **210**. The sealing plug **530** is concentrically aligned with dispensing passageway **318** when dispenser **300** is positioned inside internal cavity **280** of toothbrush handle **210**. This helps prevent inadvertent dispensing or leakage of oral care material M from dispenser **300** when docked.

While the invention has been described with respect to specific examples including presently preferred modes of carrying out the invention, those skilled in the art will appreciate that there are numerous variations and permutations of the above described systems and techniques. It is to be understood that other embodiments may be utilized and structural and functional modifications may be made without departing from the scope of the present invention. Thus, the spirit and scope of the invention should be construed broadly as set forth in the appended claims.

What is claimed is:

1. A dispenser comprising:

a housing defining a longitudinal axis;

a pressurized product tube disposed in the housing and including a reservoir containing a material;

an outlet in fluid communication with the reservoir;

a valve fluidly coupled to the outlet, the valve being movable between an open dispensing position and a closed non-dispensing position; and

a compression device disposed inside the housing of the dispenser, the compression device configured to apply pressure to the product tube for dispensing the material, wherein the compression device includes a pair of opposing pressure plates resiliently biased into engagement with opposing sides of the product tube, the plates operable to squeeze the material from the reservoir when the valve is in the open dispensing position;

wherein the valve is configured to dispense the material from the reservoir under pressure when in the dispensing position;

wherein the valve includes an orifice movable into and out of a flow path defined through the outlet; and

wherein the pressure plates are resiliently coupled together by a pair of elastomeric members each anchored to mating opposing longitudinal edges of the pressure plates along opposing lateral sides of the compression device.

2. The dispenser according to claim **1**, wherein the valve is biased towards the closed position.

3. The dispenser according to claim **1**, wherein:

when the valve is in the open dispensing position, the orifice is positioned in the flow path; and

when the valve is in the closed non-dispensing position, the orifice is positioned outside the flow path.

4. The dispenser according to claim **1**, further comprising an applicator mounted on a distal end of the dispenser in fluid communication with the reservoir.

5. The dispenser according to claim **4**, wherein the product tube includes a nozzle fluidly coupled to the applicator, the nozzle being inserted in a rearwardly open socket formed in the applicator.

6. The dispenser according to claim **1**, wherein each pressure plate is axially elongated and encloses a majority of a length of the product tube.

7. The dispenser according to claim **1**, wherein the pressure plates are transversely movable together and apart in relation to each other from a closed position to an open position, the pressure plates being biased towards the closed position by the elastomeric members.

8. The dispenser according to claim **1**, wherein the elastomeric members are formed of thermoplastic elastomers.

9. The dispenser according to claim **1**, wherein the housing is configured for insertion into a handle of a toothbrush.

10. The dispenser according to claim **1** wherein the valve is configured to dispense the material from the reservoir under constant pressure when in the dispensing position irrespective of an amount of the material contained in the reservoir.

11. An oral care system comprising:

a toothbrush including a head, and a handle coupled to the head and having an internal cavity;

a dispenser detachably mounted in the internal cavity of the handle;

the dispenser including:

a housing defining a longitudinal axis;

a pressurized tube disposed in the housing and including a reservoir containing an oral care material;

an outlet in fluid communication with the reservoir;

a valve fluidly coupled to the outlet, the valve being movable between an open dispensing position and a closed non-dispensing position; and

a compression device disposed inside the housing of the dispenser, the compression device configured to apply pressure to the product tube for dispensing the material, wherein the compression device includes a pair of opposing pressure plates resiliently biased into engagement with opposing sides of the product tube, the plates operable to squeeze the material from the reservoir when the valve is in the open dispensing position;

wherein the valve is configured to dispense oral care material from the reservoir under pressure when in the dispensing position;

wherein the valve includes an orifice movable into and out of a flow path defined through the outlet; and

wherein the pressure plates are resiliently coupled together by a pair of elastomeric members each anchored to mating opposing longitudinal edges of the pressure plates along opposing lateral sides of the compression device.

12. The oral care system according to claim **11**, wherein:

when the valve is in the open dispensing position, the orifice is positioned in the flow path; and

when the valve is in the closed non-dispensing position, the orifice is positioned outside the flow path.

13. A method for dispensing a material, the method comprising:

providing a dispenser including a housing defining a longitudinal axis, a pressurized product tube disposed in the housing and including a reservoir containing a material, and an outlet in fluid communication with the reservoir and defining a flow path for dispensing the material;

engaging opposite sides of the product tube with a compression device operably exerting an inward directed force on the reservoir;

actuating a valve fluidly coupled to the outlet of the dispenser and including a flow orifice, the orifice movable into and out of the flow path;

positioning the orifice into the flow path; and

dispensing the material from the dispenser.

* * * * *